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Abstract

This article shows that bettor sentiment for higher scores in soccer matches does not affect betting returns from *over/under 2.5 goals* bets, even though the volume wagered is highly concentrated on the *over* bet. Strong competition and high price transparency seem to prevent bookmakers from systematically exploiting bettor sentiment.

JEL Classification: D81, L83
Keywords: Sentiment, Betting Odds, Bookmaker

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1 Introduction

Sports betting is a multi-billion dollar business. FIFA (2011) estimates that sports betting generated between $350 and $400 billion in 2011 while the sports industry itself generated around $300 billion. The dominant form of sports betting is bookmaker betting. Bookmakers act as dealers by announcing the odds or point spreads that reflect the prices against which bettors can place their bets. Thereby, bookmakers enter the opposite position of each bet. As long as bettor preferences and perceptions are unbiased, bookmakers do best by setting informationally efficient odds that reflect the true winning probability of the underlying event. Otherwise, bookmakers can sustain large losses if bettors are able to recognize and exploit the biased odds (Levitt, 2004). In the presence of sentimental bettors who prefer bets with particular characteristics and who do not necessarily choose the bets with the highest expected return, optimal bookmaker pricing becomes more complex. Popular examples of bettor sentiment include the optimistic/perception bias (e.g., Kuypers, 2000; Levitt, 2004; Page, 2009) which causes bettors to overrate the winning probability of certain teams, and the loyalty bias (e.g., Forrest & Simmons, 2008; Franck, Verbeek, & Nüesch, 2011) which prevents bettors from betting against the team they support. Bettor sentiment leads to an asymmetric volume demand even when the bookmaker odds reflect the true winning probability of the underlying event.

This paper tests whether bettor sentiment affects the odds offered by bookmakers. Levitt (2004) argues that bookmakers can earn higher profits by reducing the odds for more heavily demanded bets, whereas the model of Franck et al. (2011) shows that, given a highly elastic demand, bookmakers should increase the odds offered for more heavily demanded bets. Empirical evidence on the effect of bettor sentiment on bookmaker odds is mixed. Avery and Chevalier (1999), L. Woodland and Woodland (1994), Levitt (2004) and Paul and Weinbach (2007) show that the returns for bets with higher sentimental betting volumes are abnormally low. Forrest and Simmons (2008) and Franck et al. (2011), however, find higher returns for bets with high bettor sentiment. And while Braun and

Kvasnicka (2011) find both upward and downward biases, Page (2009) does not find any evidence of biased odds due to bettor sentiment. Hence, the cumulative evidence on the effect of bettor sentiment on bookmaker pricing is weak and/or inconsistent.

One difficulty in establishing a link between bettor sentiment and bookmaker pricing is that actual betting volume data is often missing.[1] The previous literature typically employs proxy measures for sentimental betting demand such as the advice of experts, the historical success or prestige of teams (Avery & Chevalier, 1999), the difference in mean home attendance between the two opposing teams (Forrest & Simmons, 2008; Franck et al., 2011) or the number of bets placed from a betting tournament with a fixed entry fee (Levitt, 2004). Rather than relying on proxies for sentimental betting volume, we analyze the actual volume data of a large European bookmaker.

A second difficulty in establishing a link between bettor sentiment and bookmaker pricing is that bettor sentiment is often correlated with other confounders such as bettor risk or skewness preferences (Quandt, 1986; Golec & Tamarkin, 1998) and bookmaker price adjustments due to the risk of the underlying event (Shin, 1991). We avoid this problem by investigating betting returns and volume percentages of the popular *over/under 2.5 goals* betting market on soccer matches.[2] This market is beneficial for three reasons: First, there are only two possible outcomes. An *under 2.5 goals* (hereafter *under*) bet wins if the total score of both teams is 2 or less and vice versa for the *over 2.5 goals* (hereafter *over*) bet. Second, the objective probability of either event is close to 50%, so that risk considerations of both bettors and bookmakers do not affect our results. Third, bettors exhibit a natural preference for high match scores because cheering for a high score is more attractive than betting against it (Paul & Weinbach, 2009; B. Woodland & Woodland, 2010). Hence, our setting allows a clean and simple analysis of whether bettor sentiment really affects bookmaker odds.

[1] Paul and Weinbach (2007) is an exception, as they have volume data of bets on 256 NFL matches provided by the online bookmaker Sportsbook.com.

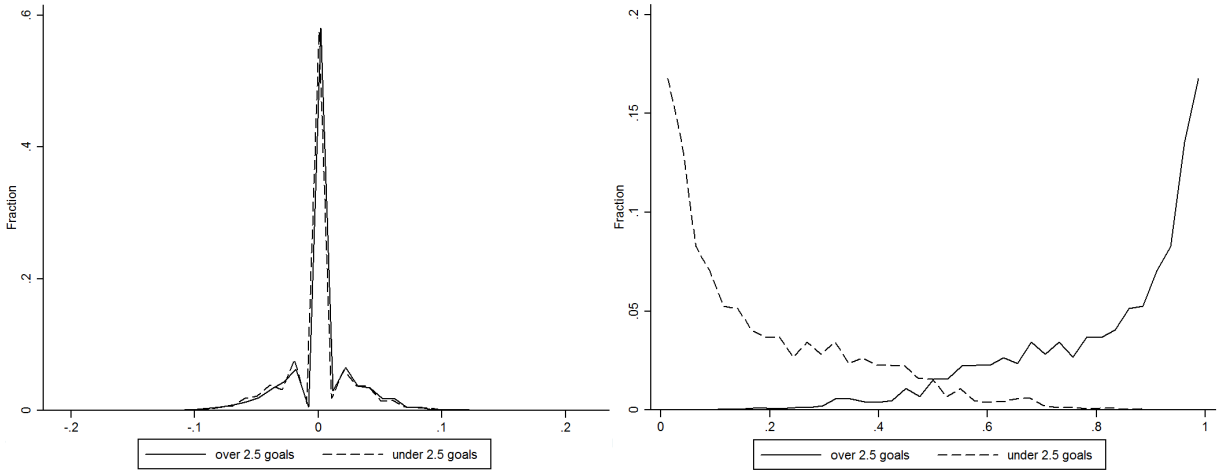
[2] The *over/under 2.5 goals* betting market is the second largest market after the *three-way* market on home win, draw or away win according to the *Betfair* volume data on soccer matches from the 2011/12 season of the English Premier League provided by *fracsoft.com*.

2 Data and Methodology

We use data on the volume percentages of money wagered on each side of the *over/under* bet. The betting volume data was provided by the bookmaker *Tipico*, which is one of the leading sports betting vendors in Germany. In addition to the online betting portal, *Tipico* has over 1,000 betting shops in several European countries. The original data sample included 4,491 soccer matches played worldwide in 220 different leagues and competitions between November 1st, 2011 and December 7th, 2011. The corresponding odds information was collected from the website *oddsportal.com*. 372 observations were deleted because bookmaker odds could not be matched.[3] Therefore, the final sample consists of 4,119 matches.

The website *oddsportal.com* publishes both opening and closing decimal odds. The opening odds are the first odds published by a bookmaker, usually one to two weeks in advance, whereas the closing odds are the last odds offered in the pre-play period before the match starts. Decimal odds denote the payoff of a successful bet. For example, if the odds for an *over* bet are 2.50, a one dollar wager pays \$2.50 if the total score is three or more. We converted the decimal odds into prices, which are the reciprocal of the decimal odds (e.g., $\frac{1}{2.50} = 0.40$). These prices indicate how much a bettor has to invest in order to collect \$1 in the event of a successful bet (Forrest & Simmons, 2008). Figure 1a shows the changes between the opening price $p_{opening}$ and closing price $p_{closing}$ of *Tipico* for both the *over* and the *under* bets. For about 60% of all bets, the closing price is the same as the opening price. The price changes in the remaining 40% of the matches appear to be small and symmetrically distributed around zero for both the *over* and the *under* bets. Price adjustments do not systematically differ between the two sides of the contract, which seems plausible given that information inflow is randomly affecting the winning probability of the *over/under* bets. The small and symmetric price adjustments are remarkable, however, when considering that the incoming betting volume

[3]The betting volume does not significantly differ between matches with and without missing odds information.



(a) Price change ($p_{opening} - p_{closing}$) (b) Betting volume

Figure 1: Distribution of price changes and volume percentages of *over/under 2.5 goals* bets

is highly asymmetric. Figure 1b illustrates the distribution of volume percentages for the *over/under* bets and shows that the betting volume on the *over* bet is often four times larger than the betting volume on the *under* bet.

Table 1 shows the average objective winning probabilities, betting volumes, bookmaker closing prices and corresponding betting returns as well as the betting returns from average bookmaker prices calculated from the prices offered by up to 62 different bookmakers including *Bwin*, *Ladbrokes* and *William Hill* for both the *over* and the *under* bets separately. Whereas the objective winning probability, the closing price as well as the returns from both *Tipico* and the average bookmaker are very similar for the *over* and the *under*

Table 1: Winning probabilities, betting volumes, prices and returns of *over/under 2.5 goals* bets

	winning		*volume*		$p_{closing}$		$r_{closing}$		$r_{AVG,closing}$	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
over	0.498	0.008	0.817	0.003	0.544	0.001	-0.086	0.015	-0.085	0.015
under	0.502	0.008	0.183	0.003	0.539	0.001	-0.068	0.015	-0.063	0.015
Δ	-0.005	0.156	0.633***	0.005	0.005	0.003	-0.018	0.029	-0.022	0.029

Notes: The table presents the results of a simple two-sided t-test for the differences in the objective winning probability (*winning*), betting volume (*volume*), the closing price ($p_{closing}$), the return from closing prices ($r_{closing}$) and the returns from the average bookmaker's closing prices ($r_{AVG,closing}$) between the *over* and the *under* bet. The number of observations for each test is 4,119. *, **, and *** denote significance at the 5%, 1% and 0.1% levels, respectively.

bets, betting volume is highly concentrated on the *over* bet, accounting for over 80% of the total betting volume.

To identify the effect of bettor sentiment on bookmaker pricing we estimate the following two-stage least-squares (2SLS) specification:

$$\begin{aligned} r_{ij} &= \beta_0 + \beta_1 \cdot p_{ij} + \beta_2 \cdot \widehat{volume}_{ij} + \epsilon_i \\ volume_{ij} &= \theta_0 + \theta_1 \cdot p_{ij} + \theta_2 \cdot over_{ij} + v_i \end{aligned} \tag{1}$$

where r_{ij} refers to the betting return for each match i and betting contract type j $e \in \{over, under\}$. p_{ij} labels the bookmaker's price and $over_{ij}$ refers to an indicator variable equaling 1 for the *over* bet and 0 otherwise. For each match i, we randomly select either the *over* or the *under* bet to ensure independence across observations. The first stage predicts the betting volume using the indicator variable $over_{ij}$ as identifying instrument. $over_{ij}$ is a valid instrument because it is highly correlated with the betting volume due to a general human preference for a high score. Such bettor sentiment is likely to affect the betting returns only through the volume wagered, because it is unrelated to potential confounders such as the winning probability of the favorite team in a match. To control for a possible influence of the price level on returns, we include the bookmaker's price in our specification.

3 Results

Columns 1 and 2 of Table 2 report the estimates of the first-stage regressions, which predict the betting volume. Our instrument *over* is a strong predictor for the volume with a partial

Table 2: 2SLS regressions of *over/under 2.5 goals* betting returns

	First stage		Dependent variable	
			$r_{opening}$	$r_{closing}$
	(1)	(2)	(3)	(4)
$\widehat{volume}$			-0.032	-0.030
			(0.047)	(0.047)
$p_{opening}$	1.567***		0.176	
	(0.028)		(0.213)	
$p_{closing}$		1.498***		0.158
		(0.026)		(0.200)
over	0.624***	0.626***		
	(0.004)	(0.004)		
Partial R^2 / R^2	87.85%	88.32%	1.24%	1.22%
N	4,119	4,119	4,119	4,119
Anderson canon. corr LR statistic			8,682***	8,845***

Notes: The table presents 2SLS estimates for the bookmaker returns from opening and closing prices. The betting volume is instrumented by the *over* indicator variable. For each match, only one bet (either *over* or *under*) is randomly included. The heteroskedasticity-robust standard errors are reported in parentheses. In all models, *, **, and *** denote significance at the 5%, 1% and 0.1% levels, respectively.

R^2 of around 88%. Columns 3 and 4 report estimates of the second-stage regressions that relate betting returns to the predicted betting volume and bookmaker prices. Neither the opening price, the closing price, nor the betting volume have a significant effect on betting returns. This finding is robust to the use of an average price calculated from the prices offered by up to 62 different bookmakers and to the exclusion of the bookmaker price. Thus, bookmakers do not exploit the bettor preference to bet on a high number of goals in a soccer match. Instead, bookmakers set the prices according to their best prediction of the true outcome probability and add an equally distributed commission.

4 Conclusion

The volume density from the *over/under* market in soccer is highly concentrated on the *over* bet, accounting for over 80% of the betting volume on average. However, this imbalance is not associated with systematic biases in betting odds. Our 2SLS estimates show no significant effect of sentimental betting volume on returns.

Bettors can easily compare the odds listed by several different bookmakers and find the best odds through a number of websites such as *oddsportal.com* or *betbrain.com*, which increases the bettors' price sensitivity. Thus, small price changes tend to have a large impact on the betting volume and eventually on the bookmaker's profit. If a bookmaker increases the price (lowers the odds) of an *over* bet, sentimental bettors would switch to a competitor. On the other hand, if a bookmaker lowers the price (increases the odds) of an *over* bet, he gains additional sentimental betting volume, however, at the risk of substantial losses. We find that bookmakers do not distort their odds in either direction. They offer odds that reflect their best prediction of the true outcome probability and add an equally distributed commission, even when bettor sentiment leads to a highly asymmetric volume distribution.

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